

Federation Execution Planner's Workbook (FEPW)

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Purpose of the FEPW

- Initially to understand RTI performance requirements and capabilities
 - How HLA is being used
 - Performance needs of actual federations
 - Input for benchmark definitions for RTIs
- Now supporting broader uses
 - Planning of federation executions
 - Insight into the entire planning process
 - Understanding relationships among federates
 - Understanding timing and coordination requirements
 - Documenting prior federation executions
 - Functional prototype for FEPW tool

What is it

- Summary Tables
- Host Table
- LAN Tables
- RTI Services Tables
- Object/Interaction Tables
- Cross-Reference Tables
- Data Representation Tables

Summary Tables

- Information about the federation execution
 - Name
 - Number of concurrent federation executions
 - RTI used
- Summary information about each federate
 - API used
 - Size
 - Tick and timing data
- Identifies hosts and LANs used by the federates

Summary Tables

Summary Tables

Federation Execution Summary Table

Federation Execution Name		Sample
Concurrent Federation Executions	Number	4
	Names	Test
		Demo
	Prototype	
RTI Software Used	Vendor	DMSO
	Version	1.3

NOTE: One table per Federation

Federate Summary Table

Fed	Name	API	Size (MB)	Tick			Time Management			Host Number	LAN Number	Notes
				Rate (/sec)	Min Value	Max Value	Regulating (y or n)	Constrained (y or n)	Lookahead			
1	Land_Simulation	Ada	10	10	0.001	0.005	Y	Y			1	
2	Land_Simulation	Ada	15	10	0.001	0.005	Y	Y		2	1	
3	Air_Simulation	C++	8	50	0.001	0.005	Y	Y		3	2	
4	Sea_Simulation	Java	7	20	0.001	0.005	Y	Y		4	2	
5	Data_Logger	Java	1	20	0.001	0.005	N	N		5	2	
6	Viewer	C++	1	10	0.001	0.005	N	Y		6	2	
7												
8												
9												
10												

Host Table

- One per federation execution
- Information on hardware
 - Computer make and model
 - Operating system
- Memory capacity of the computer
- Execution time available on the computer

Host Table

Host Table

NOTE: One table per Federation

Host	Computer			Operating System		Memory (MB)		% CPU Available to RTI	Notes
	Vendor/model	# CPUs	Speed (MHz)	Name	Version	Total (MB)	Available (MB)		
1	Sun Ultra 2	1	300	Solaris		192			
2	Sun Ultra 2	1	200	Solaris		192			
3	SGI Octane	1	300	IRIX		256			
4	Dell latitude CP	1	233	NT		64			
5	Sun Ultra 2	1	250	Solaris		192			
6	Compaq	1	233	NT		128			
7									
8									
9									
10									

LAN Tables

- One per federation execution
- Descriptive information on each LAN used
 - Type of network
 - Throughput
- LAN-to-LAN connections
 - Device
 - Throughput
 - Latency

LAN Tables

LAN Tables

LAN Description Table

LAN	Physical Type	Bandwidth	
	(Ethernet, ATM, etc.)	Specified	Available
1	Ethernet		
2	Ethernet		
3			
4			
5			
6			

NOTE: One table per Federation

LAN-to-LAN Connectivity Table

LAN	1		2		3		4		5	
1										
2	Device									
	Bandwidth									
	Latency									
3	Device		Device							
	Bandwidth		Bandwidth							
	Latency		Latency							
4	Device		Device		Device					
	Bandwidth		Bandwidth		Bandwidth					
	Latency		Latency		Latency					
5	Device		Device		Device		Device			
	Bandwidth		Bandwidth		Bandwidth		Bandwidth			
	Latency		Latency		Latency		Latency			
6	Device									
	Bandwidth		Bandwidth		Bandwidth		Bandwidth		Bandwidth	
	Latency		Latency		Latency		Latency		Latency	

Notes

RTI Services Table

- One per *federate* and *summary for federation*
- Lists current suite of RTI services
- Indicates services used at least once

RTI Services Table

RTI Services Table

NOTE: One table per Federate

Federate		1	Land_Simulation				
Service	IF	Spec	Used	Service	IF	Spec	Used
	Ref		?		Ref		?
Create Federation Execution	4.2		Y	Unconditional Attribute Ownership Divestiture	7.2		
Destroy Federation Execution	4.3			Negotiated Attribute Ownership Divestiture	7.3		
Join Federation Execution	4.4	Y		Request Attribute Ownership Assumption †	7.4		
Resign Federation Execution	4.5	Y		Attribute Ownership Divestiture Notification †	7.5		
Register Federation Synchronization Point	4.6			Attribute Ownership Acquisition Notification †	7.6		
Confirm Synchronization Point Registration †	4.7			Attribute Ownership Acquisition	7.7		
Announce Synchronization Point †	4.8			Attribute Ownership Acquisition If Available	7.8		
Synchronization Point Achieved	4.9			Attribute Ownership Unavailable †	7.9		
Federation Synchronized †	4.10			Request Attribute Ownership Release †	7.10		
Request Federation Save	4.11			Attribute Ownership Release Response	7.11		
Initiate Federate Save †	4.12			Cancel Negotiated Attribute Ownership Divestiture	7.12		
Federate Save Begun	4.13			Cancel Attribute Ownership Acquisition	7.13		
Federate Save Complete	4.14			Confirm Attribute Ownership Acquisition Cancellation	7.14		
Federate Saved †	4.15			Query Attribute Ownership	7.15		
Request Federation Restore	4.16			Inform Attribute Ownership †	7.16		
Confirm Federation Restoration Request †	4.17			Is Attribute Owned By Federate	7.17		
Federation Restore Begun †	4.18			Enable Time Regulation	8.2	Y	
Initiate Federate Restore †	4.19			Time Regulation Enabled †	8.3	Y	
Federate Restore Complete	4.20			Disable Time Regulation	8.4		
Federate Restored †	4.21			Enable Time Constrained	8.5	Y	
Publish Object Class	5.2	Y		Time Constrained Enabled †	8.6	Y	
Unpublish Object Class	5.3			Disable Time Constrained	8.7		
Publish Interaction Class	5.4	Y		Time Advance Request	8.8	Y	
Unpublish Interaction Class	5.5			Time Advance Request Available	8.9		
Subscribe Object Class Attributes	5.6	Y		Next Event Request	8.10		
Unsubscribe Object Class	5.7			Next Event Request Available	8.11		
Subscribe Interaction Class	5.8	Y		Flush Queue Request	8.12		
Unsubscribe Interaction Class	5.9			Time Advance Grant †	8.13	Y	
Start Registration For Object Class †	5.10			Enable Asynchronous Delivery	8.14	Y	
Stop Registration For Object Class †	5.11			Disable Asynchronous Delivery	8.15		
Turn Interactions On †	5.12			Query LBTS	8.16		
Turn Interactions Off †	5.13			Query Federate Time	8.17		
Register Object Instance	6.2	Y		Query Minimum Next Event Time	8.18		
Discover Object Instance †	6.3	Y		Modify Lookahead	8.19		
Update Attribute Values	6.4	Y		Query Lookahead	8.20		
Reflect Attribute Values †	6.5	Y		Retract	8.21		
Send Interaction	6.6	Y		Request Retraction †	8.22		
Receive Interaction †	6.7	Y		Change Attribute Order Type	8.23		
Delete Object Instance	6.8	Y		Change Interaction Order Type	8.24		
Remove Object Instance †	6.9	Y		Create Region	9.2		
Local Delete Object Instance	6.10			Modify Region	9.3		
Change Attribute Transportation Type	6.11			Delete Region	9.4		
Change Interaction Transportation Type	6.12			Register Object Instance With Region	9.5		
Attributes In Scope †	6.13			Associate Region For Updates	9.6		
Attributes Out Of Scope †	6.14			Unassociate Region For Updates	9.7		
Request Attribute Value Update	6.15			Subscribe Object Class Attributes With Region	9.8		
Provide Attribute Value Update †	6.16			Unsubscribe Object Class With Region	9.9		
Turn Updates On For Object Instance †	6.17			Subscribe Interaction Class With Region	9.10		
Turn Updates Off For Object Instance †	6.18			Unsubscribe Interaction Class With Region	9.11		
				Send Interaction With Region	9.12		
				Request Attribute Value Update With Region	9.13		
				Change Thresholds †	9.14		
				Enable Class Relevance Advisory Switch	10.23		
				Disable Class Relevance Advisory Switch	10.24		
				Enable Attribute Relevance Advisory Switch	10.25		
				Disable Attribute Relevance Advisory Switch	10.26		
				Enable Attribute Scope Advisory Switch	10.27		
				Disable Attribute Scope Advisory Switch	10.28		
				Enable Interaction Relevance Advisory Switch	10.29		
				Disable Interaction Relevance Advisory Switch	10.30		

Object/Interaction Tables

- One per *federate*
- Attributes updated by the federate
 - How often
 - In what groupings
- Attributes to which the federate subscribes
 - Latency constraints on updates
- Interactions generated by the federate
 - How often
- Interactions to which the federate subscribes
 - Latency constraints

Object/Interaction Tables

Object/Interaction Tables

Federate	1	Land_Simulation
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NOTE: One table per Federate

Object Table

Object Class	Attribute	Size (bytes)	Update									Subscribe		Ownership			
			y/n	Count	Nominal Rate	Maximum Rate	Conditions	Grouping	Transport (reliable or best effort)	Ordering (TSO or RO)	Routing Space	y/n	Max latency (msec)	Transfer Rate	Grouping		
Ground_unit				10													
	Attribute1	4	y					A	R	RO	RO	y	200	1/fedex		A	
	Attribute2	4	y					B	R	RO	RO	n					
	Attribute3	4	y					A	R	RO	RO	y	150				
	Attribute4	4	y					B	R	RO	RO	n					
	Attribute5	4	y					A	R	RO	RO	y	300	1/fedex		A	
	Attribute6	4	y					A	R	RO	RO						

Interaction Table

Interaction Class	Parameter	Size (bytes)	Send									Subscribe				
			y/n	Nominal Rate	Maximum Rate	Conditions	Grouping	Transport (reliable or best effort)	Ordering (TSO or RO)	Routing Space	y/n	Max latency (msec)				
Interaction1																
	Parameter1	4	y					A								
	Parameter2	4	y					B								
	Parameter3	4	y					A								
	Parameter4	4	y					B								
	Parameter5	4	y					A								
	Parameter6	4	y					A								

Grouping Description Table

Type	Grouping	Description
Update	A	Position change
Update	B	Damage to unit
Transfer	A	C2 control
Send	A	Radar-guided missile
Send	B	Fire-and-forget missile

Notes

Cross Reference Tables

- One per federation
- Attributes updated or reflected by each federate
- Attributes transferred or accepted by each federate
- Interactions initiated or sensed, or reacted to by each federate
-

Cross Reference Tables

Cross-Reference Tables

Object Attribute Update/Reflect Table

NOTE: One table per Federation

Object Class	Attribute	Federates									
		1	2	3	4	5	6	7	8	9	10
Ground_unit	Attribute1	U/R	U/R	R	R	R	R				
	Attribute2	U/R	U/R	R	R	R	R				
	Attribute3	U/R	U/R	R	R	R	R				
	Attribute4	U/R	U/R				R				

Object Attribute Transfer/Accept Table

Object Class	Attribute	Federates									
		1	2	3	4	5	6	7	8	9	10
Ground_unit	Attribute1	T/A	T/A								
	Attribute2	T/A	T/A								
	Attribute3	T/A	T/A								
	Attribute4	T/A	T/A								

Interaction Initiate/Receive Table

Interaction Class	Parameter	Federates									
		1	2	3	4	5	6	7	8	9	10
Interaction 1	Parameter1	I	R	R			S				
	Parameter2	I/R	R	R	I/R		S				
	Parameter3	I/R	R	R	I/R		S				
	Parameter4	I/R	R	R	I/R		S				

Notes

Data Representation Tables

- One per federation
- How data is represented in the federation
- Byte ordering
- Complex data sequence and packing
-

Data Representation Tables

Data Representation Tables

NOTE: One table per Federation

Base Type Definition Table

Data Type	Size	Code	Notes
Byte ordering	n/a	BigEndian	Big endian (most significant bit first)
float	32	OMT	IEEE single-precision floating point number
double	64	OMT	IEEE double precision floating point number
short	16	OMT	16-bit two's complement integer value in the range $-2^{15} - 1$
unsigned short	16	OMT	16-bit integer value in the range 0 to $2^{16} - 1$
long	32	OMT	32-bit two's complement integer value in the range -2^{31} to $2^{31} - 1$
unsigned long	32	OMT	32-bit integer value in the range 0 to $2^{32} - 1$
long long	64	OMT	64-bit two's complement integer value in the range -2^{63} to $2^{63} - 1$
unsigned long long	64	OMT	64-bit integer value in the range 0 to $2^{64} - 1$
char	8	OMT	8-bit quantity with a numerical value between 0 and 255
boolean	1	OMT	1 bit quantity which can take only the values 0 or 1
octet	8	OMT	8-bit quantity guaranteed not to undergo any conversion
any	n/a	OMT	permits the specification of values which can express any basetype
string	n/a	OMT	One-dimensional array of chars which is terminated with a null (0) char
sequence	n/a	OMT	One-dimensional array of any base type with max size and length

Complex Data Type Definition Table

Complex Type	Elements			Notes
	Element	Type	Size	
Type 1	Element1	float	32	
	Element2	short	16	
		padding	16	
	Element3	long	32	
	Element4	boolean	1	
		padding	31	
	Element6	string	64	